

## Silicon N-Channel Planar Power MOSFET

### Description

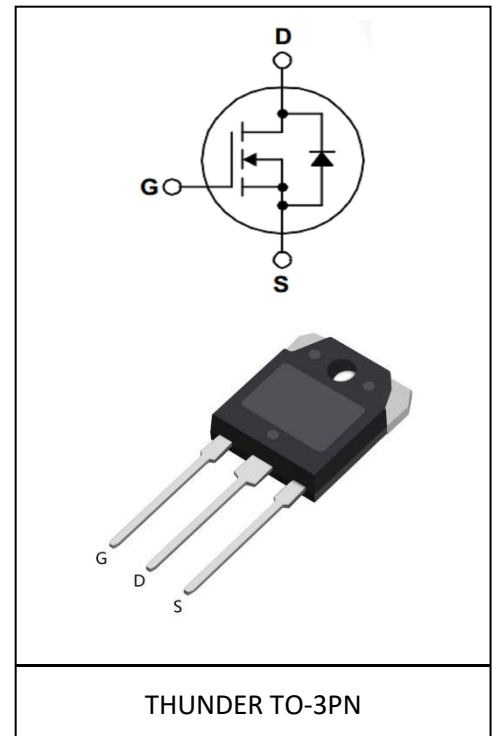
The TH23N50PB utilizes the latest processing techniques to achieve low on-resistance per silicon area. Additional features of this MOSFET are 150°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications. It can be used in a wide variety of applications.

### General Features

- $V_{DS}=500V, I_D=23A$
- Low ON Resistance,  $R_{DS(ON)}=185m\Omega @ V_{GS}=10V, I_D=11.5A$
- Low reverse transfer capacitance
- Low Qg for fast response
- Short fall & rise times for fast switching
- 100% single pulse avalanche energy Test

### Application

- Power switching application
- Digital amplifier
- Adapter and charger



### Product Summary

$V_{DS}$	500V
$R_{DS(on)}$	185m $\Omega$
$I_D$	23A

### Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	500	V
Continuous drain current $T_C = 25^\circ C$ (Silicon limit)	$I_D$	23	A
Pulsed drain current ( $T_C = 25^\circ C$ , $t_p$ limited by $T_{jmax}$ )	$I_{DM}$	92	A
Avalanche energy, single pulse ( $L=10mH$ , $R_g=25\Omega$ )	$E_{AS}$	1930	mJ
Gate-Source voltage	$V_{GS}$	$\pm 30$	V
Power dissipation ( $T_C = 25^\circ C$ )	$P_D$	305	W
Operating junction and storage temperature	$T_j, T_{stg}$	-55...+150	$^\circ C$

### Thermal Resistance

Parameter	Symbol	Max	Unit
Thermal resistance, junction – case.	$R_{thJC}$	0.41	°C/W
Thermal resistance, junction – ambient(min. footprint)	$R_{thJA}$	40	

### Electrical Characteristic (at $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

### Static Characteristic

Drain-source breakdown voltage	$BV_{DSS}$	500	-	-	V	$V_{GS}=0V, I_D=250\mu A$
Gate threshold voltage	$V_{GS(th)}$	2.0	-	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu A$	$V_{DS}=500V, V_{GS}=0V$ $T_j=25^\circ C$
		-	-	10	$\mu A$	$V_{DS}=400V, V_{GS}=0V$ $T_j=125^\circ C$
Gate-source leakage current	$I_{GSS}$	-	-	$\pm 100$	nA	$V_{GS} = \pm 30V, V_{DS} = 0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	185	227	m $\Omega$	$V_{GS} = 10V, I_D = 11.5A$
Transconductance	$g_{fs}$	-	24.6	-	S	$V_{DS} = 40V, I_D = 11.5A$

### Dynamic Characteristic

Input Capacitance	$C_{iss}$	-	4180	-	pF	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$
Output Capacitance	$C_{oss}$	-	310	-		
Reverse Transfer Capacitance	$C_{rss}$	-	3.2	-		
Gate Total Charge	$Q_g$	-	48	-	nC	$V_{GS} = 10V, V_{DS} = 400V,$ $I_D = 23A$
Gate-Source charge	$Q_{gs}$	-	14	-		
Gate-Drain charge	$Q_{gd}$	-	20	-		
Turn-on delay time	$t_{d(on)}$	-	92	-	ns	$V_{DD} = 250V, I_D = 23A,$ $R_G = 25\Omega$
Rise time	$t_r$	-	365	-		
Turn-off delay time	$t_{d(off)}$	-	95	-		
Fall time	$t_f$	-	85	-		
Gate resistance	$R_G$	-	1	-	$\Omega$	$V_{GS}=0V, V_{DS}=0V,$ $f=1MHz$

### Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	$V_{SD}$	-	-	1.4	V	$V_{GS}=0V, I_{DS}=23A$
Body Diode Continuous Forward Current	$I_S$	-	-	23	A	$T_C=25^\circ C$
Body Diode Reverse Recovery Time	$t_{rr}$	-	505	-	ns	$T_C=25^\circ C, I_S=23A, di/dt=100A/us$
Body Diode Reverse Recovery Charge	$Q_{rr}$	-	7.1	-	$\mu C$	

### Typical Performance Characteristics

Fig 1: Output Characteristics

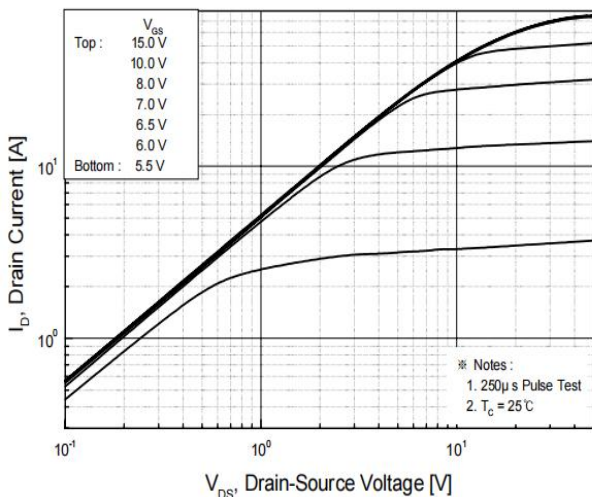


Fig 2: Transfer Characteristics

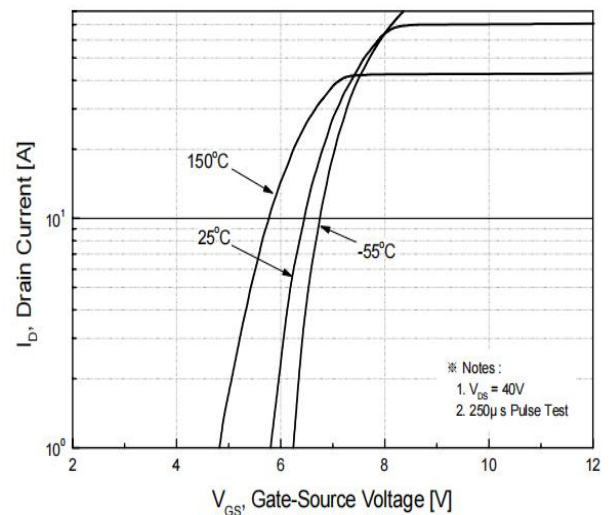


Fig 3:  $R_{DS(on)}$  vs Drain Current and Gate Voltage

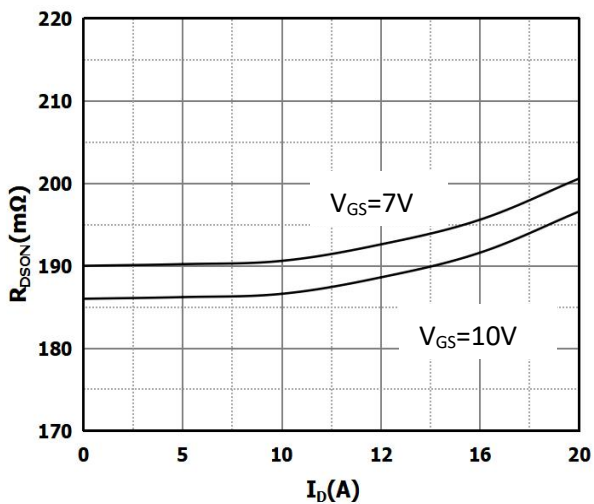


Fig 4:  $R_{DS(on)}$  vs Gate Voltage

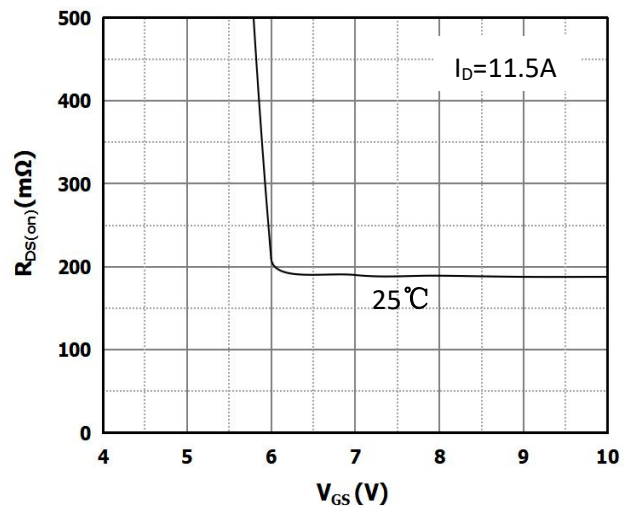


Fig 5:  $R_{DS(on)}$  vs. Temperature

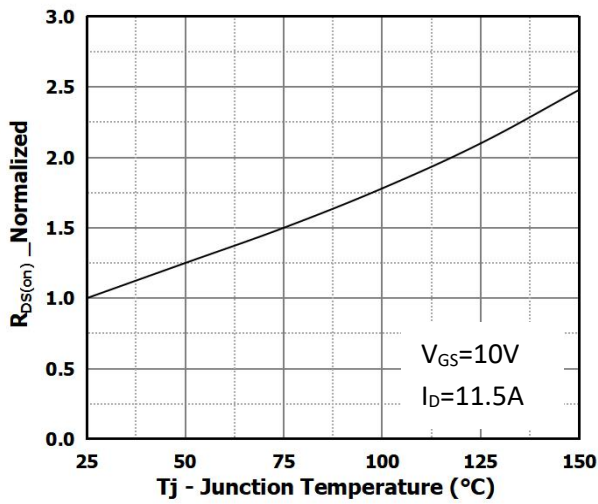


Fig 6: Capacitance Characteristics

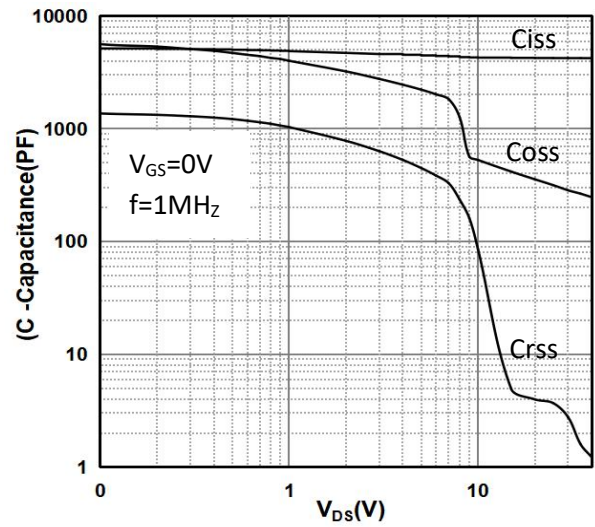


Fig 7: Gate Charge Characteristics

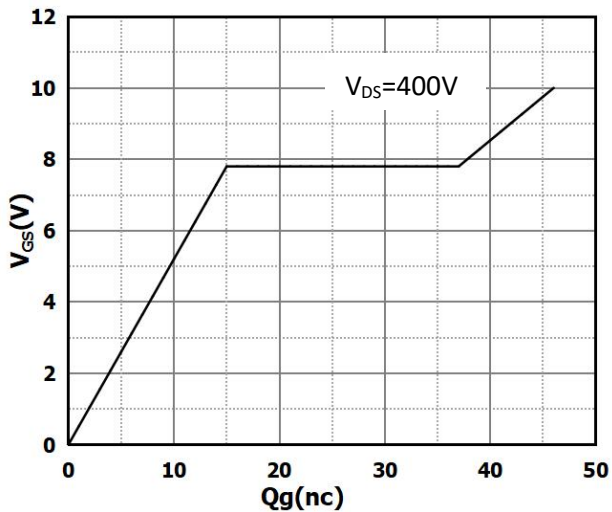


Fig 8: Body-diode Forward Characteristics

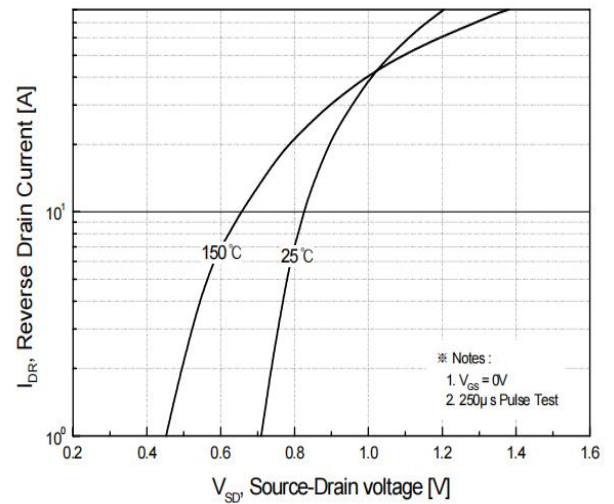


Fig 9: Power Dissipation

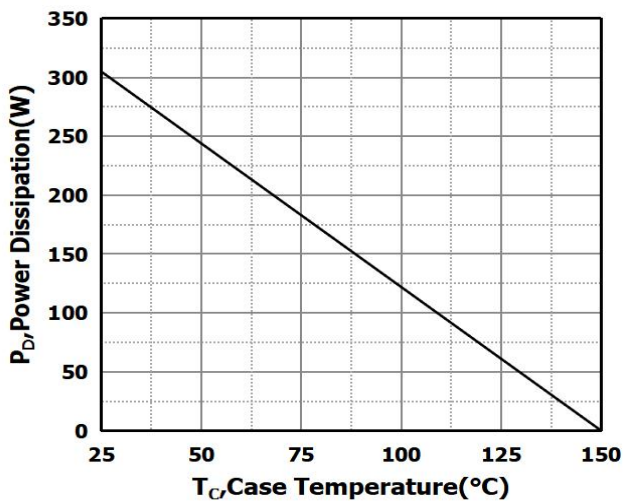


Fig 10: Drain Current Derating

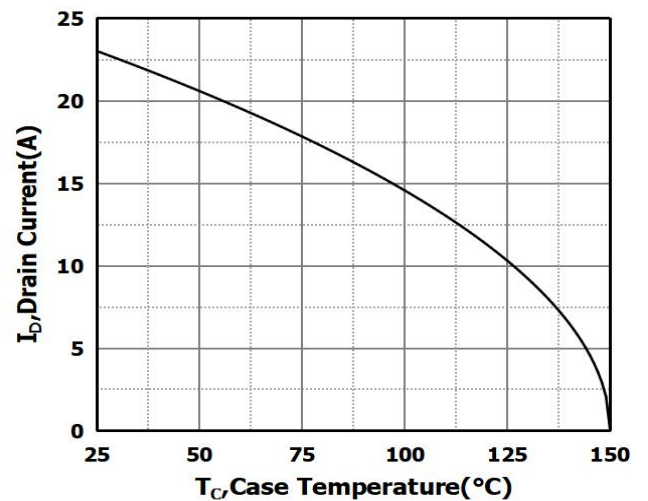
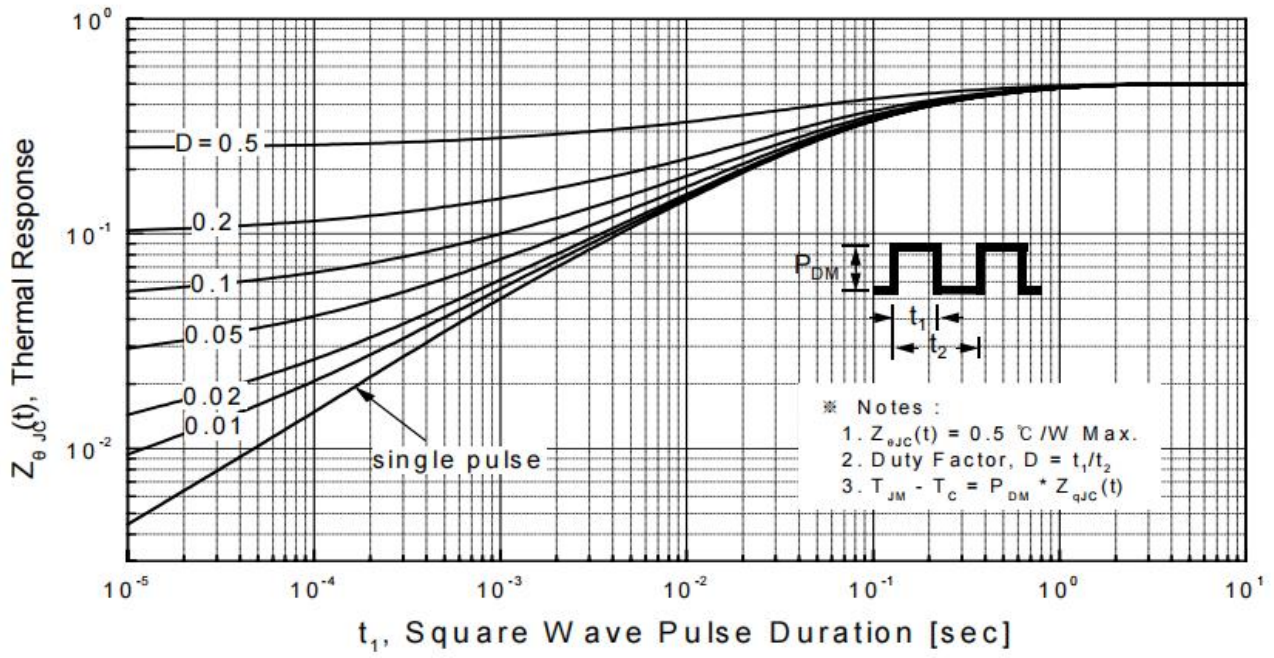


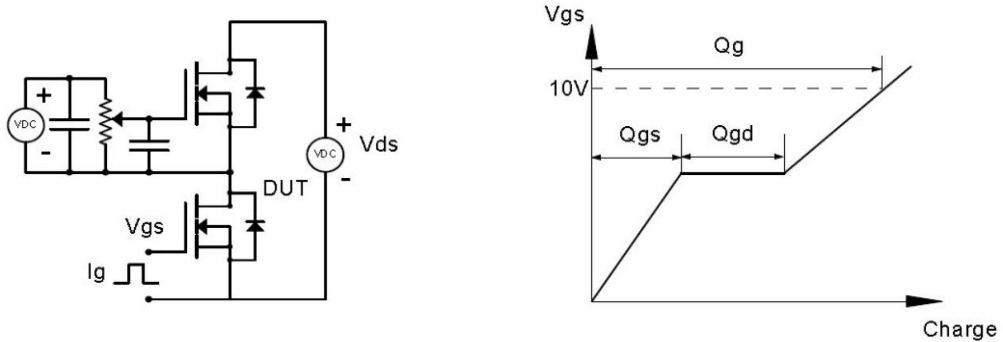
Fig 11: Transient Thermal Response Curve



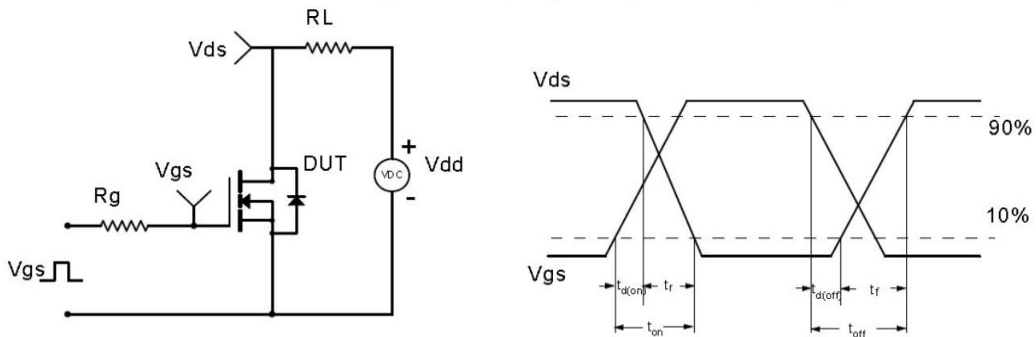


## Test Circuit & Waveform

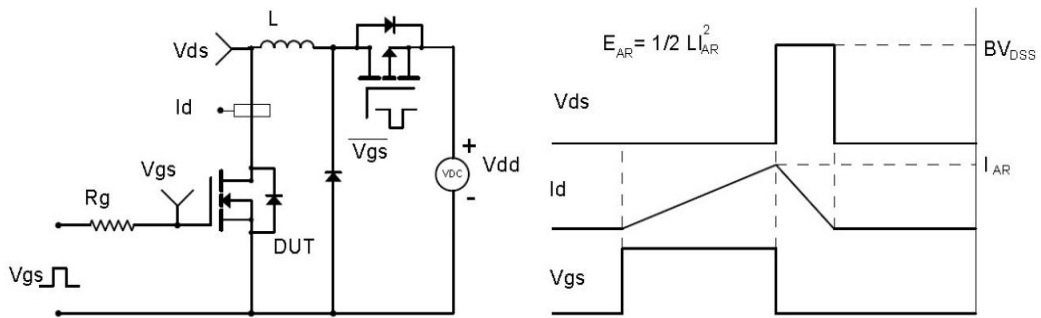
Gate Charge Test Circuit & Waveform



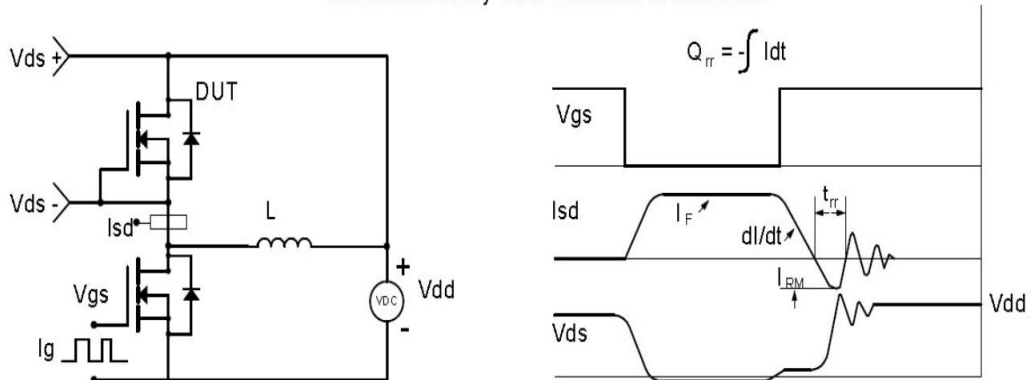
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



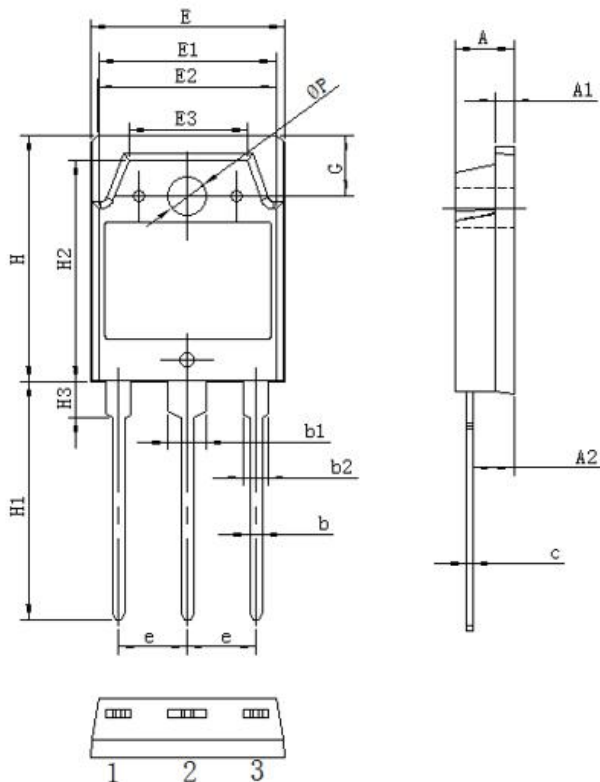
Diode Recovery Test Circuit & Waveforms



## Package Information

### TO-3PN PACKAGE

#### 基本尺寸



Symbol	单位 mm		
	Min	Nom	Max
A	4.60	4.80	5.00
A1	1.3	1.5	1.7
A2	2.20	2.40	2.60
b	0.80	1.0	1.20
b1	2.90	3.10	3.30
b2	1.90	2.10	2.30
c	0.50	0.60	0.70
e	5.25	5.45	5.65
E	15.2	15.6	16.0
E1	13.2	13.4	13.6
E2	13.1	13.3	13.5
E3	9.1	9.3	9.5
H	19.8	20.0	20.2
H1	19.4	19.8	20.2
H2	18.5	18.7	18.9
H3	2.9	3.1	3.3
G	4.8	5.0	5.2
$\Phi P$	3.00	3.20	3.40

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